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TRANSLATION

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USE OF MOLYBDENUM SULFIDE AS A LUBRICANT FOR COLD ROLLING OF TUBES  
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Synopsis.

Performance of molybdenum sulfide as lubricant in the cold rolling of small-diameter tubes. Procedure developed for depositing it onto surface of tools (plugs). Effect of sulfide coating on friction coefficient, pressure of stock on rolls, and sticking of tubes to working surface of plug. Relation between effectiveness of molybdenum sulfide lubrication and specific pressure of metal on plug. Conclusions drawn from results.

According to published information (1-5)  $\text{MoS}_2$ , molybdenum sulfide, has in recent times become widely used as a lubricant.

A procedure for depositing this sulfide on tools is sand blasted, degreased, washed with hot water, and a suspension of  $\text{MoS}_2$ , alcohol and glue VF-2 is deposited on the dry surface (20% sulfide, 1-2% of glue and the rest alcohol - volume percentages). The tool is then left in the air for the alcohol to evaporate (1-2 minutes) and the dry lubricant is rubbed into the tool with felt. Special emphasis should be laid on the need for degreasing the tool surface before applying the sulfide. Tools thus treated were tried out at the plant. At the start of rolling the first tube, the coefficient of friction between tube and plug (mandrel) treated by the method described, was greater than in rolling on a polished plug. There was a spontaneous decrease of feed and an increase in the total pressure of metal on the rolls. However, with further rolling of the first tube the coefficient of friction considerably decreased - the surface of the mandrel 'ran in'. There was a spontaneous sharp increase in feed of tube with a simultaneous decrease of the total pressure of the metal on the rolls (Fig 1).

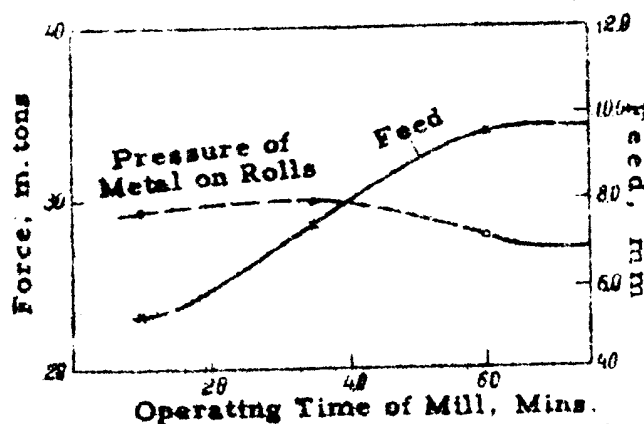


Fig. 1. Change in total pressure of metal on rolls and amount of feed in running in a sand-blasted plug lubricated with  $\text{MoS}_2$ . Tube steel: 18-8Ti; 32. 2x2 to 26x0.95 mm:

The feed was greater in rolling the second tube than when rolling on a polished plug. Further changes in feed ceased after rolling 3-5 tubes. The pressure of the metal on the rolls was 10-15% lower in rolling on mandrels with treated surfaces (after running in) than on polished mandrels.

The advantage of a mandrel with  $\text{MoS}_2$ -treated surfaces over other forms of mandrel is the decrease of adhesion of metal to the mandrel, which occurs only after the surface layer has completely worn away. The bond of sulfide with the surface is so strong that it can only be removed by wearing away the surface completely. The wear resistance of such a surface is very high. For example, in rolling tubes of 18-8Ti steel measuring 18x1.0 mm (0.7x0.04 in) from 32x2.2 mm (1.25x0.086 in) blanks, the mean life of the mandrel was increased 10 times by sulfide treatment. Similar results with treated mandrels were obtained in rolling tubes through a pass with sulfide treated surfaces. The pressure of metal on the rolls was 15-20% lower than in rolling through a pass with a polished surface and the axial force acting on the blank was correspondingly diminished (Fig. 2).

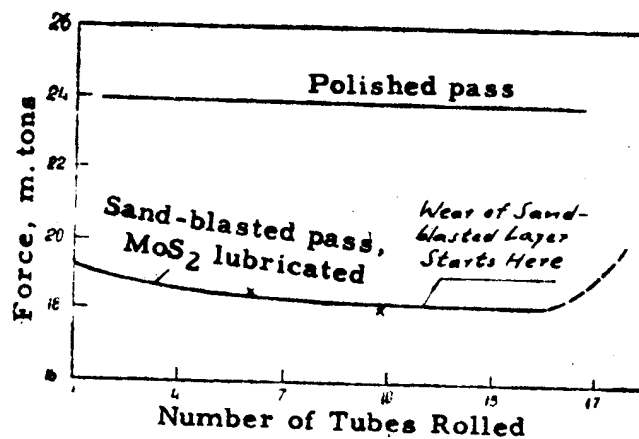


Fig. 2. Variation of metal pressure on rolls when rolling tubes from 57x4 to 25x2.0 mm at a feed of 2.4 mm. Steel 448 (0.12% C max., 2.0 Mn, max., 0.8 Si, 16-19 Cr, 11-14 Ni, 2-3 Mo, 0.3-0.6 Ti).

However the wear of the surface layer occurred considerably quicker. Hence, it has been established that:

1. The use of tools with a surface covered with  $\text{MoS}_2$ , employing an ordinary lubricant, lowers the coefficient of friction, the pressure on the metal of the rolls (10-20%) and the adhesion of the worked metal to the working surface of the tool. The resistance of the mandrel to adhesion of metal is doubled to trebled. The quality of the surface of the worked tubes is correspondingly improved.
2. The effectiveness of the action of the sulfide increases considerably with increase of the specific pressure of the metal on the tool. This suggests that it would be most effective to use the sulfide for rolling particularly thin-walled tubes, deep drawing, etc.
3. To find out the best lubricant when  $\text{MoS}_2$  is present on a tool surface requires additional experiment, from which still more valuable results can be expected.

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